

Terrestrial Hydrological Data From NASA's Hydrology Data and Information Services Center (HDISC): Products, Services, and Applications

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A series of land surface state (e.g., soil moisture and surface temperature) and flux (e.g., evaporation and sensible heat flux) products simulated by land surface models (CLM, Mosaic, Noah, SAC and VIC) from the North American and Global Land Data Assimilation Systems (NLDAS and GLDAS) are now accessible at the Hydrology Data and Information Services Center (HDISC), a component of NASA Goddard Earth Sciences Data and Information Services Center (GES DISC).

Hydrology Data and Information Services Center (HDISC)

The Hydrology DISC currently supports the North American and Global Land Data Assimilation Systems (NLDAS and GLDAS, respectively) data products generated by GSFC's Hydrological Sciences Branch. HDISC has the capability to support more hydrology data products and provide more advanced data access and visualization tools. The goal is to develop HDISC as a data and services portal that supports weather and climate forecast, and water and energy cycle research (<http://disc.gsfc.nasa.gov/hydrology>).

North American (NLDAS) and Global Land Data Assimilation Systems (GLDAS)

NLDAS and GLDAS integrate data from multiple space-based Earth observing systems using advanced land surface modeling and assimilation techniques. These products support weather and climate forecast experiments, water resources applications, and water and energy cycle research.

	NLDAS	GLDAS
Content	Water and energy budget data, forcing data	
Spatial extent	Conterminous U.S., parts of southern Canada and northern Mexico	All land north of 60°S
Spatial resolution	0.125°	1.0° and 0.25°
Time period	Jan 1, 1979 to present for NLDAS-2 Oct 1, 1996 to Dec 31, 2007 for NLDAS-1 (to be released)	Jan 1, 1979 to present for 1.0° data Feb 24, 2000 to present for 0.25° data
Temporal resolution	Hourly and monthly	3-hourly and monthly
Forcing	Multiple data sets derived from satellite measurements, radar estimation, precipitation gauges, and atmospheric analyses	Multiple data sets derived from satellite measurements and atmospheric analyses
Land surface models	Mosaic, Noah, SAC, VIC	CLM, Mosaic, Noah, VIC
Output format	GRIdded Binary (GRIB)	
Elevation definition	GTPOPO 30	
Vegetation definition	University of Maryland, 1 km	

Parameters for GLDAS (Left), NLDAS-2 Forcing (Middle) and NLDAS-2 Mosaic output (Right)

PDS IDs	Full Name	Unit	PDS IDs	Full Name	Unit
001	Surface pressure	Pa	NLDAS-2 Primary Forcing Data		
011	Near surface air temperature	K	61	Precipitation hourly total	kg/m ²
032	Near surface wind magnitude	m/s	157	180-0 mb above ground convective available potential energy	J/kg
051	Near surface specific humidity	kg/kg	153	Fraction of total precipitation that is convective	unitless
057	Total evapotranspiration	kg/m ² /s	205	LW radiation flux downwards (surface)*	W/m ²
065	Snow water equivalent	kg/m ²	204	SW radiation flux downwards (surface)	W/m ²
071	Total canopy water storage	kg/m ²	228	Potential evaporation	kg/m ²
085	Average layer soil temperature	K	1	Surface pressure*	Pa
086	Average layer soil moisture	kg/m ²	51	2-m above ground specific humidity*	kg/kg
099	Snowmelt	kg/m ² /s	11	2-m above ground temperature*	K
111	Net shortwave radiation	W/m ²	33	10-m above ground zonal wind speed	m/s
112	Net longwave radiation	W/m ²	34	10-m above ground meridional wind speed	m/s
121	Latent heat flux	W/m ²	NLDAS-2 Secondary Forcing Data		
122	Sensible heat flux	W/m ²	179	Aerodynamic conductance	m/s
131	Snowfall rate	kg/m ² /s	63	Convective precipitation hourly total	kg/m ²
132	Rainfall rate	kg/m ² /s	61	Precipitation hourly total	kg/m ²
138	Average surface temperature	K	204	SW radiation flux downwards (surface)	W/m ²
155	Ground heat flux	W/m ²	7	NARR hybrid level geopotential height	gpm
204	Surface incident shortwave radiation	W/m ²	1	NARR hybrid level pressure	Pa
205	Surface incident longwave radiation	W/m ²	51	NARR hybrid level specific humidity	kg/kg
234	Subsurface runoff	kg/m ² /s	11	NARR hybrid level temperature	K
235	Surface runoff	kg/m ² /s	33	NARR hybrid level zonal wind speed	m/s
			34	NARR hybrid level meridional wind speed	m/s
			65	Accumulated snow water-equivalent	kg/m ²

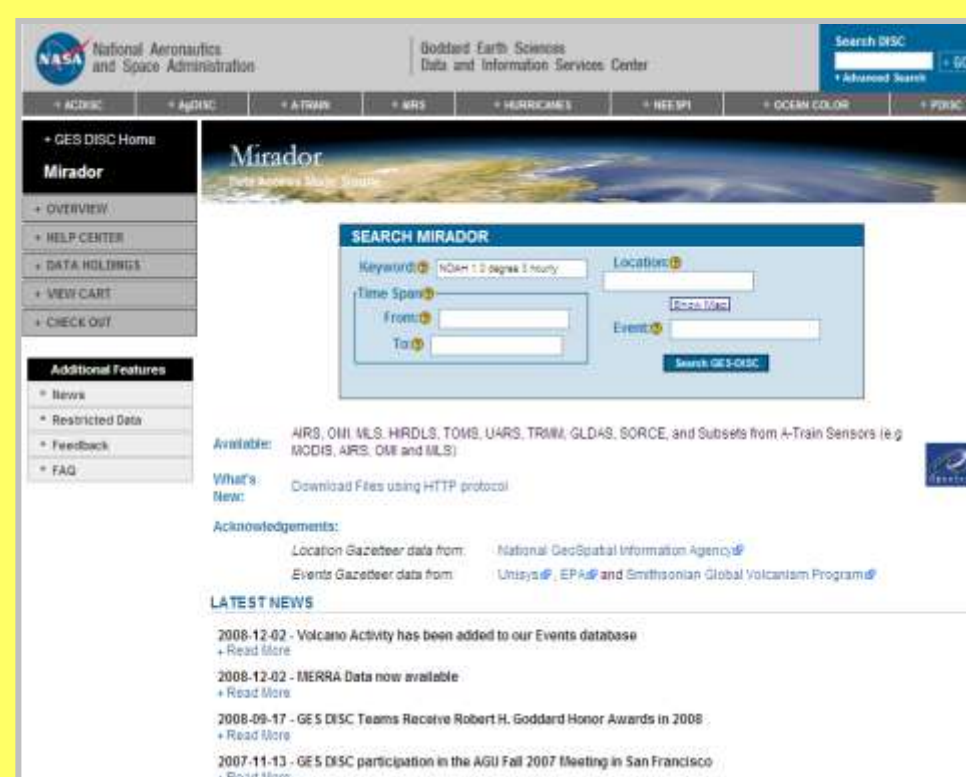
Access HDISC Data

- Anonymous http and ftp data downloading
- Mirador - providing discovery of, and access to, a Google-like search and download tool, based on keywords

HDISC Data Holdings

Product	Resolution	Time Period	Temporal Resolution	Output Format
CLM	1.0°	1979-present	3-hourly	GRIB
Mosaic	0.125°	1979-present	3-hourly	GRIB
Noah	0.125°	1979-present	3-hourly	GRIB
SAC	0.125°	1979-present	3-hourly	GRIB
VIC	0.125°	1979-present	3-hourly	GRIB

Mirador Data Search Interface



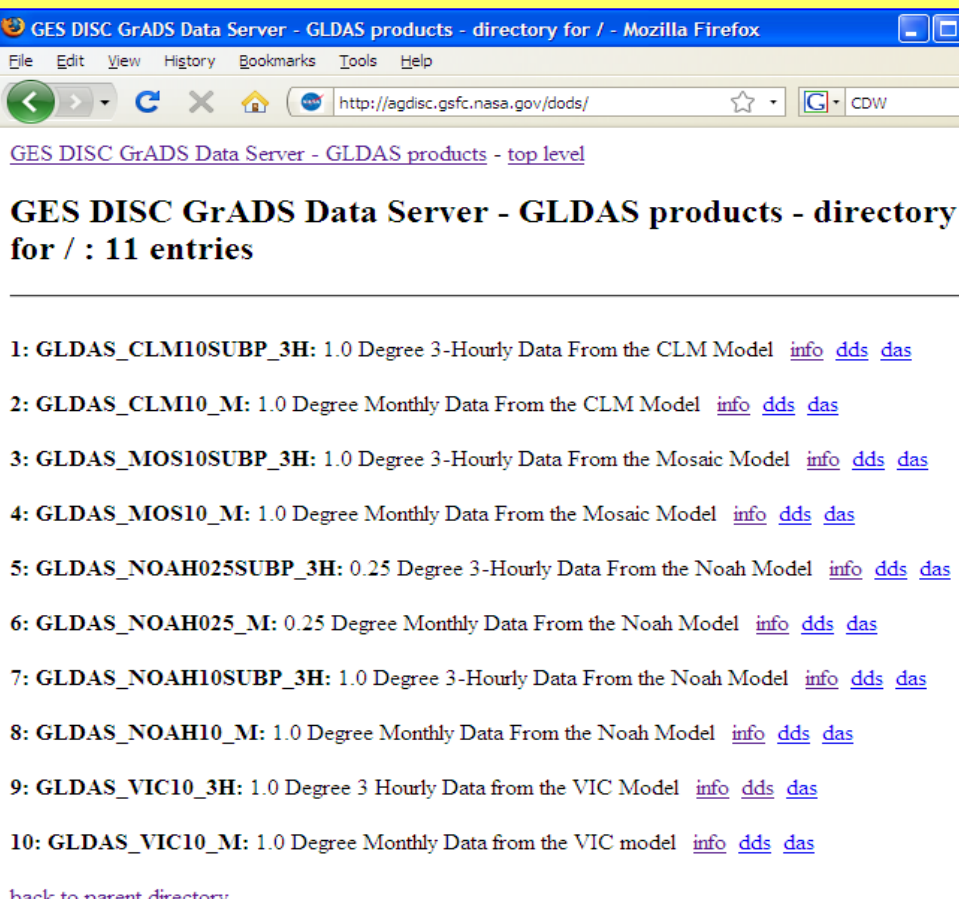
GrADS Data Server (GDS)

GDS provides subsetting and analysis services across the internet. GDS supports any operation that can be expressed in a single GrADS expression.

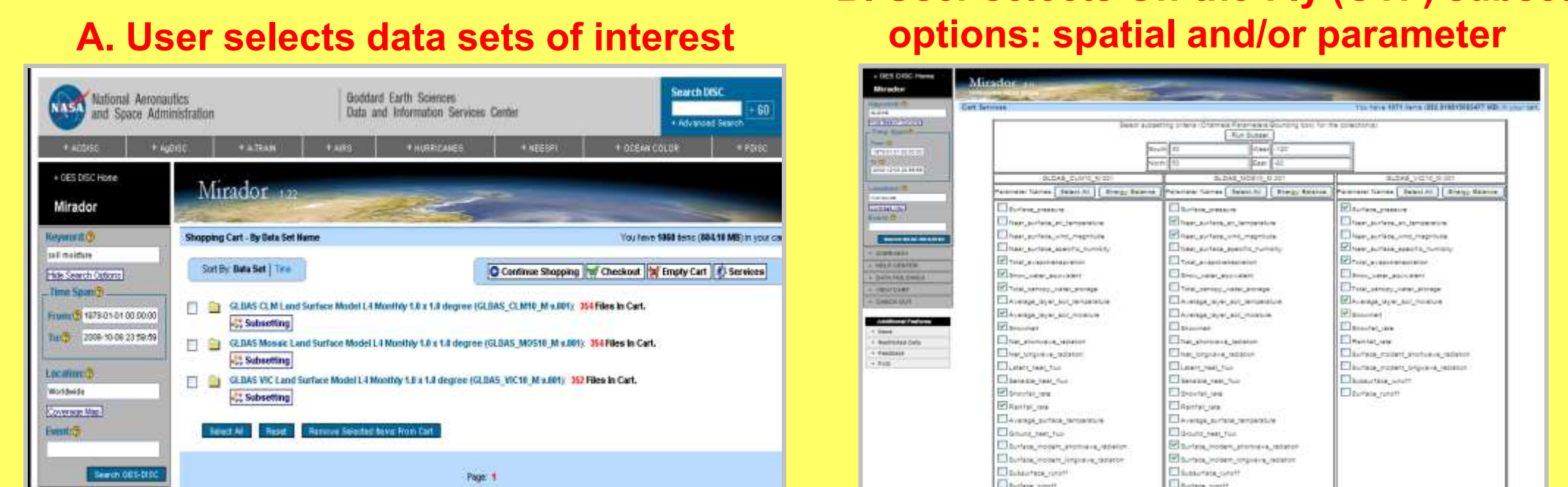
GES DISC GDS for NLDAS products



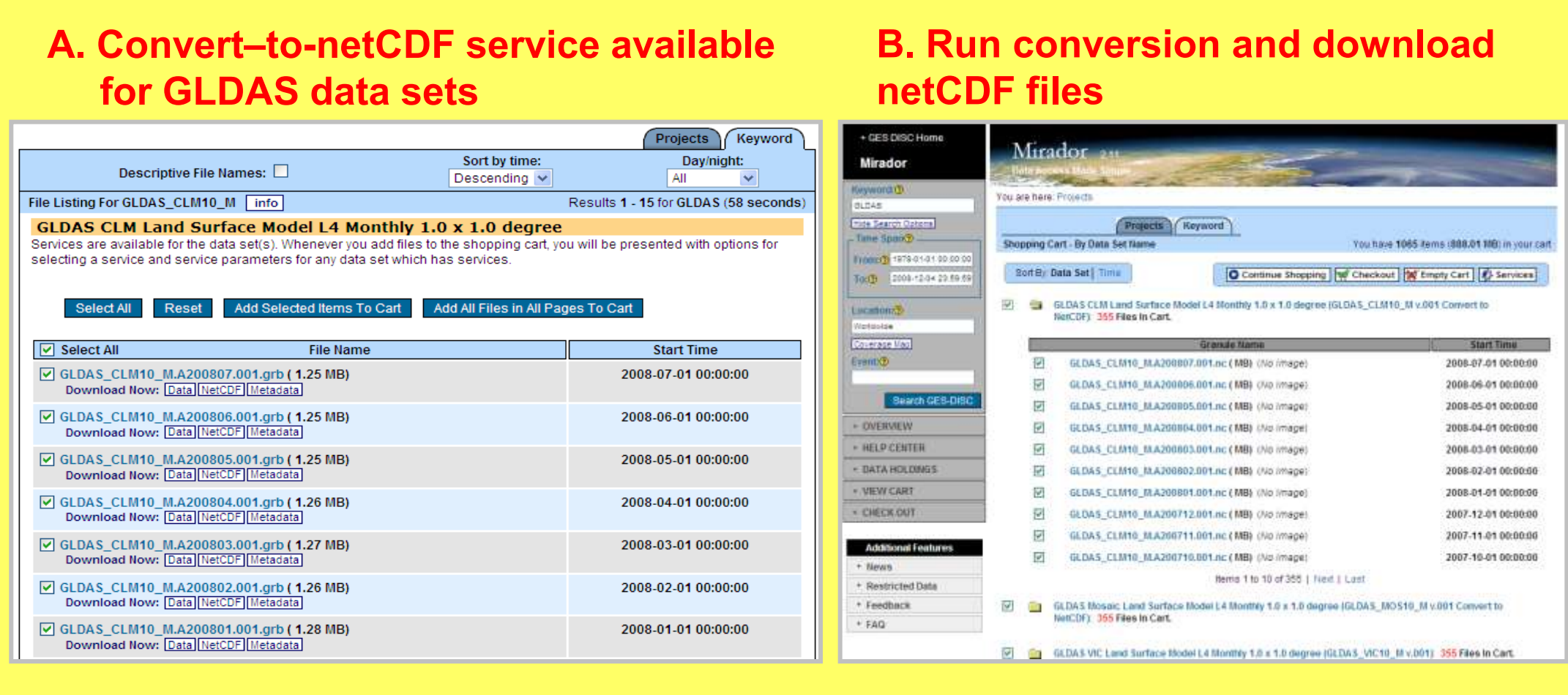
GES DISC GDS for GLDAS products



On-The-Fly Spatial and Parameter Subset for GLDAS



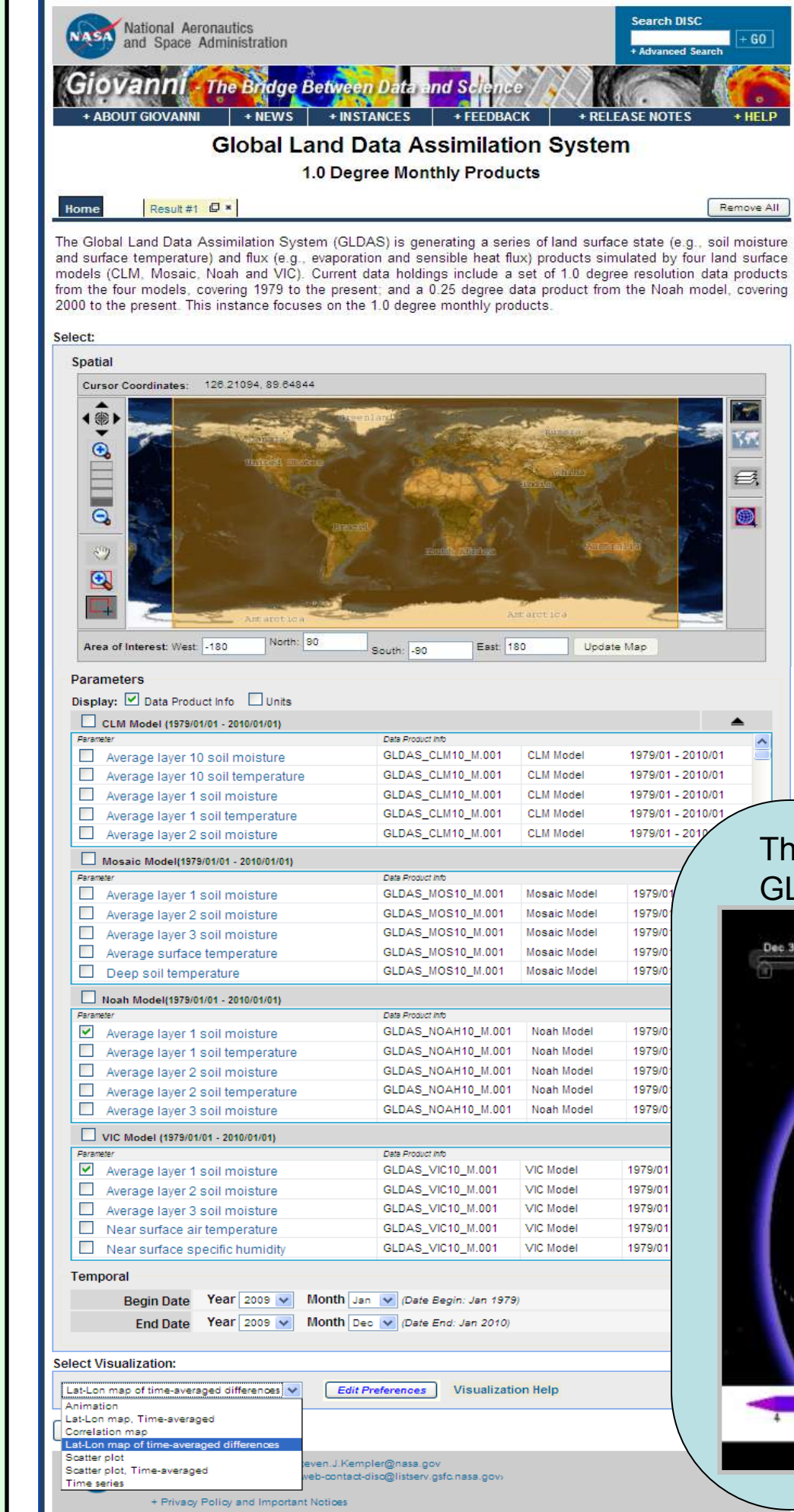
On-The-Fly Conversion to netCDF



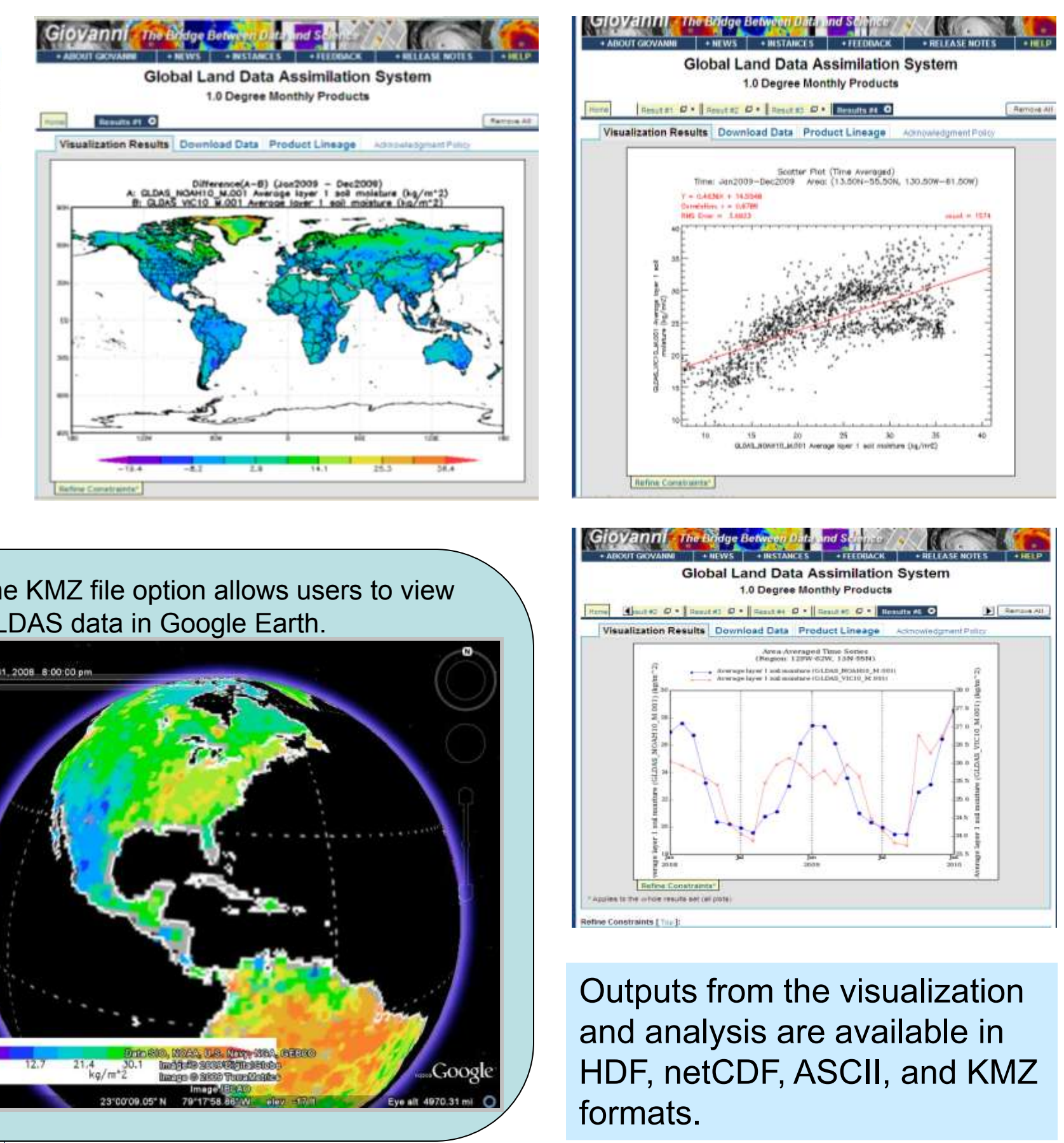
Online Visualization and Analysis (Giovanni)

Giovanni is a simple and intuitive way to visualize, analyze, and access Earth science remote sensing data online.

<http://giovanni.gsfc.nasa.gov/>



GLDAS Giovanni users simply select one or more parameters, spatial and temporal ranges, and a visualization function. The examples below show the differences in soil moisture estimates from the Noah and VIC models.



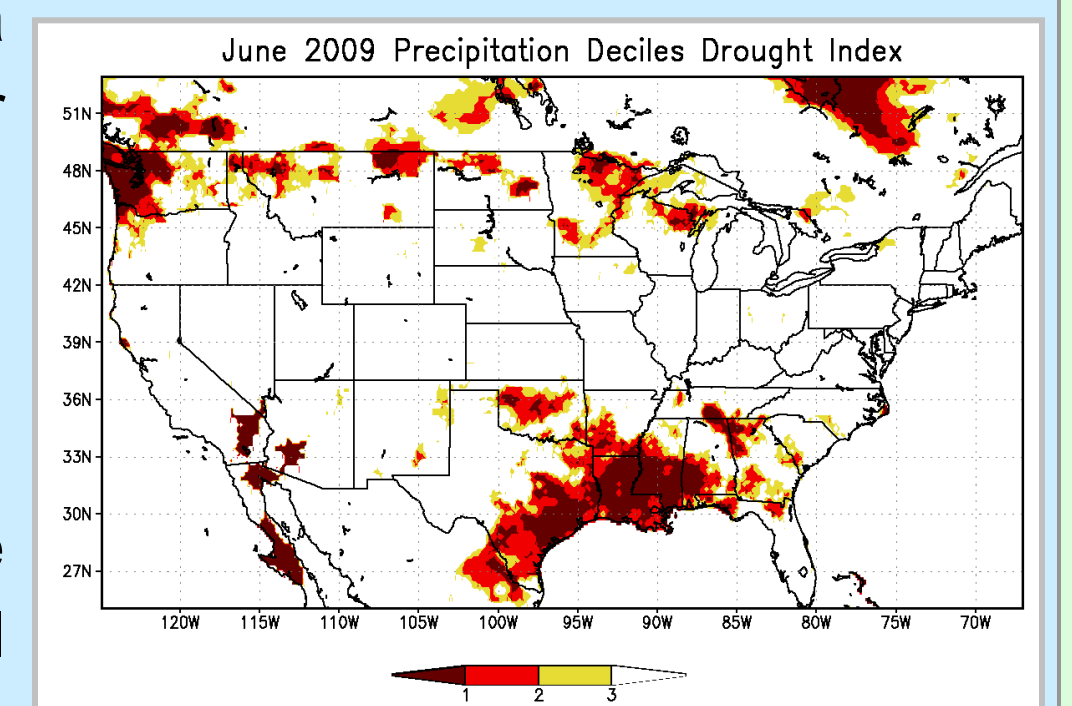
Drought Monitoring With NLDAS Data

Precipitation deciles drought index from the NLDAS forcing data

NLDAS-2 data are used in various combinations in a post-processor to generate different drought indices for the three main types of droughts to be investigated:

- Meteorological (primarily from precipitation deficit)
- Hydrological (primarily from streamflow/runoff deficit)
- Agricultural (primarily from soil moisture deficit)

The different drought indices and outputs from separate land surface models will be evaluated against historical and current drought observations.



NLDAS Drought Monitor: <http://www.emc.ncep.noaa.gov/mmb/nldas/drought/>

Further Development

- Support additional NLDAS products and monthly products.
- Advanced Giovanni services for GLDAS and NLDAS products.
- Support GLDAS new processing with improved forcing data set.
- Support NLDAS products for EPA BASINS application.

Mitchell, K.E., D. Lohmann, P.R. Houser, E.F. Wood, J.C. Schaake, A. Robock, B.A. Cosgrove, J. Sheffield, Q. Duan, L. Luo, R.W. Higgins, R.T. Pinker, J.D. Tarpley, D.P. Lettenmaier, C.H. Marshall, J.K. Entin, M. Pan, W. Shi, V. Koren, J. Meng, B.H. Ramsay, and A.A. Bailey, 2004: The multi-institution North American Land Data Assimilation System (NLDAS): Utilizing multiple GCIP products and partners in a continental distributed hydrological modeling system. *J. Geophys. Res.*, **109**, D07S90, doi:10.1029/2003JD003823.

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